EFFECTIVENESS OF HEAVY THERSHOLD VERSUS MILD THRERSHOLD INSPIRATORY MUSCLE TRAINING IN PATIENTS WITH COPD

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The Dissertation entitled

EFFECTIVENESS OF HEAVY THERSHOLD VERSUS MILD THRERSHOLD INSPIRATORY MUSCLE TRAINING IN PATIENTS WITH COPD

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Dissertation submitted to

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Dissertation evaluated on ----------

Internal Examiner External Examiner

CERTIFICATE I

This is to certify that the dissertation entitled **"Effectiveness of Heavy thershold versus mild threshold Inspiratory Muscle Training in Patients with COPD"** was carried out by **Reg. No. 271530204,** P.P.G College of Physiotherapy, Coimbatore-35, affiliated to the Tamilnadu Dr. M.G.R medical university, Chennai-32, under the guidance of me

Prof. K. Raja Shenthil M.P.T (Cardio)., MIAP.,(PhD)

Principal &Guide

CERTIFICATE II

This is to certify that the dissertation entitled **"Effectiveness of Heavy thershold versus mild threshold Inspiratory Muscle Training in Patients with COPD"** was carried out by **Reg. No. 271530204,** P.P.G College of Physiotherapy, Coimbatore-35, affiliated to the Tamilnadu Dr. M.G.R medical university, Chennai-32, under my guidance and direct submission.

Prof. , M.P.T (Cardio)., MIAP.,
Guide

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EFFECTIVENESS OF HEAVY THERSHOLD VERSUS MILD THERSHOLD INSPIRATORY MUSCLE TRAINING IN PATIENTS WITH COPD

ABSTRACT

Purpose of the study:

The aim of the study was to compare the effectiveness of Heavy threshold and mild threshold inspiratory muscle training in COPD patients.

Methodology:

A total number of 30 subjects were selected and divided into High intensity inspiratory and mild threshold inspiratory group with 15 patients in each. Prior to muscle training dyspnoea during daily activities, QOL and respiratory exertion will be measured. Heavy threshold Inspiratory muscle training with 30% Of PImax initially ;increasing upto 60-90% of PImax as training load and mild threshold Inspiratory muscle training with 10% PImax initially and increasing upto 30%PImax as training load was given. Training was given 3 times per week for 8 weeks. Pre and post test results were compared within the group and mean difference was compared between the groups.

Result:

The Pre Vs Post mean of Group-A was 1.7; the Pre Vs Post mean of Group –B was 1 and the mean difference of Group A and Group B was 0.7; and the Pre Vs Post mean of Group-A was 3.27; the Pre Vs Post mean of Group –B was 2.4 and the mean difference of Group A and Group B was 0.87, which showed significant greater reduction in Perception of Dyspnoea and improvement in Quality of Life (QOL) in Heavy thershold Inspiratory Muscle trained Group A when compared to mild thershold Inspiratory Muscle trained Group B.

Conclusion:

The study showed that the Heavy threshold Inspiratory Muscle Training was most effective than mild threshold Inspiratory Muscle Training on Perception of Dyspnoea and Quality of Life (QOL).

CHAPTER I
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Chronic Obstructive Pulmonary Disease (COPD) is the third most burdensome disease and fourth leading cause of death affecting approximately 17.2% of the population, especially in males, in those with more than 20 pack-years of smoking and in low income subjects.

It is characterized by progressive airflow limitation and is associated with increase in neutrophils, macrophages and T-lymphocytes in various parts of the lung, which are driven by inflammatory mediators, particularly cytokines, chemokines and oxidants. This "Abnormal" inflammatory reaction to risk factors is believed to be responsible for the most important pathologic abnormalities of COPD.

Chronic obstructive pulmonary disease COPD is a progressive disease with functional decline leading to disability.

Our understanding of the natural history of COPD is skewed to the more severe stages of COPD, those patients who are most often required for clinical trial inclusion. Few studies have focused on mild to moderate COPD or enrolled patients with the multiple co-morbidities that occur in this population.7 Depression, cardiovascular disease and osteoporosis have been documented in as many as 40% of patients with severe and very severe COPD, but little is known about the prevalence of these morbidities in those with more moderate disease.

In one survey of 3000 patients with COPD, 56% were found to have breathlessness during normal physical activities and 42% reported breathlessness while doing household chores.

Progression of COPD results in dyspnoea during activities of daily living with respiratory exertion and reduced health-related quality of life. Optimizing function through a reduction in dyspnoea has been identified as a key goal for the management of COPD (McKenzie et al 2005). It is notable that body exercise training does not improve respiratory muscle strength or endurance (Weiner et al 1992).

Inspiratory Muscle Dysfunction contributes to the origin of dyspnoea in COPD (Rochester 1991), therefore addition of specific inspiratory muscle training to whole body exercise may yield further reductions in dyspnoea.

In recent years, the concept of "health-related quality of life" has gained importance in the assessment of healthcare interventions. Health-related quality of life allows assessment of multiple domains in the experience of chronic illness.

COPD health status measurements, such as the St. George Respiratory Questionnaire (SGRQ) and Chronic Respiratory Questionnaire (CRQ), provide complementary information to that obtained from spirometry. Although they have an established place in clinical trials, they have not been incorporated into routine clinical assessment.

It appears that specific loading of the inspiratory muscles with commercially available hand-held devices using training intensities of at least 30% of the previously determined maximum inspiratory pressure can improve inspiratory muscle strength and endurance thereby reducing dyspnoea (Lotters et al 2002)

The present study reveals the effects of high and low intensity inspiratory muscle training on dyspnoea and quality of life in moderate COPD patients.

1.2 NEED OF THE STUDY

Consequently, we have limited information on COPD patients seen at the less disabling stages that account for much of the care provided by family physicians and general internists. We also know little about how these “real world” patients are being recognized, how frequently inspiratory muscle training is used, and the degree of lung function impairment in those diagnosed with COPD. In addition, there is little published data about how muscle training for these patients is adherent to COPD management guidelines and whether or not they remain symptomatic despite therapy.

1.3. AIM OF THE STUDY

The aim of the study was to compare the effectiveness of High intensity and Low intensity inspiratory muscle training in moderate COPD patients.

1.4. OBJECTIVES OF THE STUDY

- To determine the effect of Heavy threshold inspiratory muscle training on dyspnoea during daily activities and QOL.
- To determine the effect of Mild threshold inspiratory muscle training on dyspnoea during daily activities and QOL.
- To find out the effective intensity of inspiratory muscle training in moderate COPD patients.

1.5. HYPOTHESIS

Null Hypothesis

The null hypothesis states that there was no significant difference in Heavy threshold and Mild threshold inspiratory muscle training on dyspnoea and QOL in moderate COPD patients.

Alternate Hypothesis

The alternate hypothesis states that there was significant difference in Heavy threshold and Mild threshold muscle training on dyspnoea and QOL in moderate COPD patients

1.6. OPERATIONAL DEFINITIONS

Chronic obstructive pulmonary disease:

COPD includes chronic lung diseases (i.e., chronic bronchitis, emphysema) that are characterized by progressive obstruction of the airflow into and out of the lungs and increased dyspnoea.

Self-Administered Version of the Chronic Respiratory Disease Questionnaire (CRQ-SAS):

The standardized dyspnoea domain includes 5 questions that evaluate 5 activities that produce respiratory difficulties in most patients with COPD:

1. Feeling emotions, such as anger or disgust.
2. Personal hygiene (bathing, showering, eating or dressing).
3. Walking.

4. Performing routine daily activities (housework, shopping, errands, grocery shopping).

5. Participating in social activities (meeting with family, friends, neighbors or groups).

Dyspnoea:

Dyspnoea sometimes referred to as ‘shortness of breath’ or ‘breathlessness’ by the patient, is a common and significant symptom of patients with chronic obstructive pulmonary disease.

CHAPTER II
REVIEW OF LITERATURE

Gavin Sturdy et.al., (2015)

Conducted an experimental study to assess the feasibility of high-intensity, Interval-based respiratory muscle training in COPD.9 patients with moderate to severe COPD were assigned to receive three 20 min sessions per week, each session comprising seven 2min bouts of breathing against a constant inspiratory threshold load, each bout separated by 1min. Respiratory muscle strength and endurance were measured before and after training. Result showed significant improvement in PI max on completion of training and was concluded that high-intensity, interval-based respiratory muscle training is feasible resulting in improvements in respiratory muscle strength and endurance in moderate to severe COPD when performed 3times a week for 8weeks.

Covey et. al., (2014)

Conducted an experimental study on High intensity Inspiratory Muscle Training in COPD. 27 patients were assigned randomly to an Inspiratory Muscle Training (IMT) group or an educational control group to receive training with inspiratory pressure loads equal to 30% of maximal inspiratory pressure (PImax) and increased as tolerated to 60% of PImax for 30min a day for 16weeks using interval training techniques. Inspiratory muscle strength (PImax), respiratory muscle endurance (discontinuous incremental threshold loading test)[DIT4], dyspnoea (Chronic Respiratory Disease Questionnaire), and the Borg Scale ratings of perceived breathing difficulty (RPBD) were measured before and after training. The result showed that in the IMT group, PImax increased from 64-75cmH2O,performance on DC-ITL test increased from maximal load of 37-53cm H2O, RPBD decreased from 5.5 to 3.8 for equal loads on DC-ITL and the CRQ Dyspnoea Scale improved from 18.1-22.4.

David Hilman et. al., (2014)

Conducted an experimental study on the effects of an Interval-based high intensity inspiratory muscle training on Inspiratory muscle function, exercise

capacity, dyspnoea and QOL.16 subjects were assigned to receive H-IMT at highest tolerable inspiratory threshold load and 17 subjects were assigned to receive S-IMT at 10% of PImax for 3times per week for 8weeks. Results showed significant increase in PImax by 29%,maximum threshold pressure by 56% and reduced dyspnoea and fatigue following H-IMT than S-IMT. It was concluded that H-IMT improves inspiratory muscle function in subjects with moderate-to-severe COPD and reductions in dyspnoea and fatigue.

Villafranca et. al, (2004)

Conducted an experimental study on the effect of inspiratory muscle training with an intermediate load on inspiratory power output in COPD. 31 patients were randomly divided into Group 1 trained with 30% PI max; Group 2 with 10% PI max and Group 3 also trained with 30 % PI max and all groups used a threshold device for 10weeks.The power output during an incremental threshold test was evaluated before and after training. Result showed increment of maximal power output in all groups, increment being higher in groups trained with 30% PI max and it was concluded that in patients with COPD, the use of an intermediate threshold load for training improves power output.

Marinella Beckerman et. al,(2004)

Conducted an experimental study on the effect of 1 year of specific inspiratory muscle training in patients with COPD. 42 patients were randomized into a group that received IMT for 1 year and control group that received training with a very low load. Result showed significant increase in inspiratory muscle strength , endurance, a decrease in the Borg score and improvement in HRQL in the training group but not in control group.

Nield.M.A (2004)

Conducted a pilot study to evaluate the ability of patients with COPD to accomplish 6weeks of IMT using a pressure threshold device, and to observe how the training affected inspiratory muscle strength and dyspnoea. 4 adults with severe COPD were assigned IMT sessions of 5 to 30 min duration and weekly training load increments of -2 to -4cmH2O over 6 week period with training device at loads of >30% of baseline PI max. Result showed improvement in inspiratory muscle strength

and reduced dyspnoea on all subjects and was concluded that using a constant load pressure threshold device to attain loads of >30% of patient's baseline PI max is a feasible way to accomplish IMT in adults with severe COPD.

Lisboa et. al,(2003)

Conducted an experimental study on the effect of Inspiratory Muscle Training on exercise capacity in patients with chronic airflow limitation. 10 patients in Group 1 were assigned to receive training with 30% of PI max as a training load and 10 patients in Group 2 were assigned to receive training with 10% of PI max for 30 min daily for 6 days a week. Changes in PI max and dyspnoea were measured before and after training. Result showed significant increment in PI max in both groups and dyspnoea improved only in Group 1 and was concluded that inspiratory muscle training using a load of 30% PI max, reduces dyspnoea & increases walking capacity.

Hildegard et. al, (2003)

Conducted an experimental study on the effect of inspiratory muscle training on dyspnoea, exercise performance and quality of life in COPD.20 patients were randomly divided into training group (Group 1) receiving 60-70% maximal sustained inspiratory pressure (SIP max) as a training load for 30 min daily, 6 days a week for 6 months and a control group (Group 2) received no training. Changes in dyspnoea and HRQL were measured. Results showed significant increases in SIP max, PI max in Group 1 than Group 2 and it was concluded that targeted IMT relieves dyspnoea and improves HRQL in COPD patients.

Preusser et. al, (2002)

Conducted an experimental study on the effect of High Intensity and Low Intensity Inspiratory muscle training in patients with COPD. 12 patients were assigned to receive supervised high resistive loading at 52% PI max and 8 patients were assigned to receive supervised low resistive loading at 22% PI max. Training was given 3 times weekly from 5min to 18min per session for 12 weeks and PI max, Incremental Inspiratory threshold loading (PITL) , Inspiratory muscle endurance (IE) were taken as a parameter before and after 3 practice sessions. Result concluded that there was no significant difference between high and low resistive interval training in more severely impaired patients with COPD.

Harver et. al, (2001)

Conducted an experimental study on the effect of targeted inspiratory muscle training on respiratory muscle function, clinical ratings of dyspnoea and perception of resistive loads in patients with COPD.19 patients with moderate to severe COPD, assigning 10 patients to an Experimental Group (EG) and 9 to a Control Group(CG). Patients in the EG trained at 6 increasing levels of inspiratory resistance, whereas patients in the CG trained at a constant level of resistance for 15 minutes twice each day using a device that provided breath-to-breath visual feedback. Results showed significant increase in inspiratory muscle strength, decreased dyspnoea in the EG compared with CG and was concluded that targeted inspiratory muscle training enhance respiratory muscle function and reduce dyspnoea in symptomatic patients moderate to severe COPD.

Larson, et. al , (2001)

Conducted a comparative study on Inspiratory Muscle training (IMT) with a pressure threshold breathing device in patients with COPD. 22 patients were randomized into two groups comparing the effects of 2 months of IMT with pressure threshold breathing device at inspiratory pressure loads equal to either 15 or 30% of each patient's (PI max).12 patients were assigned in Group 1 to receive 15% load and 10 patients were assigned in Group 2 to receive 30% load. PI max , Endurance time and 12 min distance walk were measured before and after training. Result showed that 30% load improved PI max, Endurance time and 12min distance walk than with 15% load showed no improvements. It was concluded that the 30 % load was more effective than the 15% load in this sample.

Belman et.al, (2000)

Conducted an experimental study on the effect of targeted resistive ventilatory muscle training in COPD.17 patients were randomized into High Intensity training group using resistance plus target feedback device(TFD) and Low Intensity training group using resistor plus TFD. Result showed significant increase in PI max, Maximal sustained ventilatory capacity , Mean mouth pressure ,Peak Inspiratory flow rate and Maximal sustained work rate more in High Intensity training group. This study concluded that targeted ventilatory muscle training with control of breathing strategy improves both ventilatory muscle strength and endurance.

CHAPTER III

METHODOLOGY

3.1 Study Design:

Comparative Study Design.

3.2 Study Setting:

The study was conducted at outpatient Department, PPG College of Physiotherapy, and Ashwin Hospital, Coimbatore under the supervision of concerned authority.

3.3 Sample Size:

A total number of 30 subjects were selected and divided into High intensity inspiratory and low intensity inspiratory group with 15 patients in each.

3.4 Sampling Method:

Convenient sampling method

3.5 Selection Criteria:

3.5.1 Inclusion criteria

- COPD patients having spirometric evidence of significant airflow limitation FEV_1 ranging 40-80%.
- Stable clinical and functional status
- Dyspnoea limited to (4-6) during ADL using Modified Borg Scale
- Age 40-60 years

3.5.2 Exclusion Criteria

- Dyspnoea at rest
- Cardiac disease
- Body mass index (BMI) > 35 kgs m^{-2}
- Previous lung surgery
- Use of long term O_2 therapy

- Poor compliance
- Drug and Alcohol abuse
- Co_2 retention

3.6 Study Duration:

6 months (Intervention - 3 times per week for 8 weeks)

3.7 Materials:

1. Threshold Inspiratory Muscle Trainer
2. Dyspnoea - Modified Borg scale
3. Quality of Life - Chronic Respiratory Disease Questionnaire Self Administered Standardized Format

3.8 Parameter:

Dyspnoea:

Dyspnoea in daily activities was assessed using modified Borg Scale.

Quality of life:

It was assessed by using the Chronic Respiratory Disease Questionnaire Self Administered Standardized Format (CRQ-SAS)

3.9 Procedure:

Thirty patients with evidence of significant COPD were recruited for the study with consideration of inclusion and exclusion criteria. After the informed consent was obtained, the patients were divided into Heavy threshold inspiratory and Mild threshold inspiratory training group with 15 subjects in each group. Prior to muscle training dyspnoea during daily activities, QOL and respiratory exertion will be measured. Heavy threshold Inspiratory muscle training with 30% Of PImax initially ;increasing upto 60-90% of PImax as training load and Mild threshold Inspiratory muscle training with 10% PImax initially and increasing upto 30%PImax as training load was given. The training session lasts for 15 minutes which comprise of 2 min of

breathing on Threshold inspiratory Muscle Trainer followed by 1 min of rest. Training was given 3 times per week for 8 weeks. Pre and post test results were compared within the group and mean difference was compared between the groups.

3.10 Technique:

The following techniques were used for training the Heavy threshold Inspiratory Muscle and Mild threshold Inspiratory Muscle group. After selection of 30 subjects with significant COPD according to inclusion criteria, the subjects were made aware of the respiratory muscle training programme.

Heavy threshold Inspiratory Muscle Training Protocol

The training was performed using a Threshold Inspiratory Muscle Trainer with 30% of PImax as training load initially and increasing upto 60% of PImax. While performing the breathing exercise, the subjects wore a nose clip to ensure breathing exclusively through the training device.

Frequency - 3 times per week for 8 weeks
Intensity - 30% to 60% of PImax
Time - 15 minutes
Type - High Intensity

Mild thershold Inspiratory Muscle Training Protocol

The training was performed using a Threshold Inspiratory Muscle Trainer with 10% of PI max as training load initially and increasing upto 30% of PI max. While performing the breathing exercise, the subjects wore a nose clip to ensure breathing exclusively through the training device.

Frequency - 3 times per week for 8 weeks
Intensity - 10% to 30% of PImax
Time - 15 minutes
Type - Low Intensity

3.11 Statistical Tool:

The collected data were subjected to statistical analysis using paired and unpaired "t" test to find out the research effectiveness.

Paired "t" Test

The paired t – test is used to find out the statistical significance between pre and post – test values of dyspnoea during daily activities, QOL before and after treatment for Group A and Group B separately.

Formula: Paired "t" test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

d = Difference between the pre Test Vs post Test

$\bar{d}$ = Mean difference

n = Total number of subjects

s = Standard deviation

Unpaired "t" test

The unpaired t – test is used to compare the statistically significant differences of dyspnoea during daily activities, QOL between group A & group B

Formula: Unpaired "t" test

$$S = \sqrt{\frac{(n_1-1)\, s_1^2 + (n_2-1) S_2^2}{n_1+n_2-2}}$$

$$t = \frac{\overline{x_1} - \overline{x_2}}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

n_1 =Total number of subject in Group – A

n_2 =Total number subject in Group – B

x_1 =Difference between Pre test Vs post test of Group A

$\overline{x_1}$ =Mean difference between pre Test Vspost test of Group A

x_2 =Difference between pre test Vs post Group – B

$\overline{x_2}$ =Mean difference between Pre test Vs post test of Group - B

The statistical tools used in the study are Paired t-test and Unpaired t-test.

CHAPTER IV

DATA ANALYSIS AND RESULT

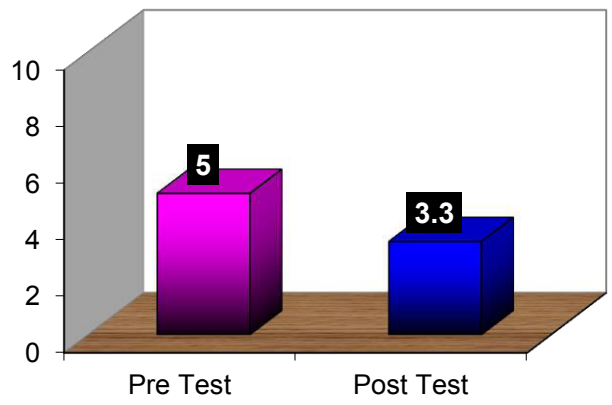
This chapter deals with the analysis of datas collected from 30 COPD patients to compare the difference between Heavy threshold inspiratory muscle and Mild threshold inspiratory muscle training. Collected data were analyzed and tabulated in the following section.

Table I - Perception of Dyspnoea for Group A

The comparative mean values, mean difference, standard deviation and Paired t-values between Pre Vs Post test of Perception of Dyspnoea in Heavy threshold Inspiratory Muscle trained Group-A.

S. No	Perception of Dyspnoea	Improvement			Paired t-value
		Mean	Mean difference	S.D	
1.	Pre-test	5	1.7	0.75	10.32
2	Post- test	3.3			

Graph I – Perception of Dyspnoea for Group A



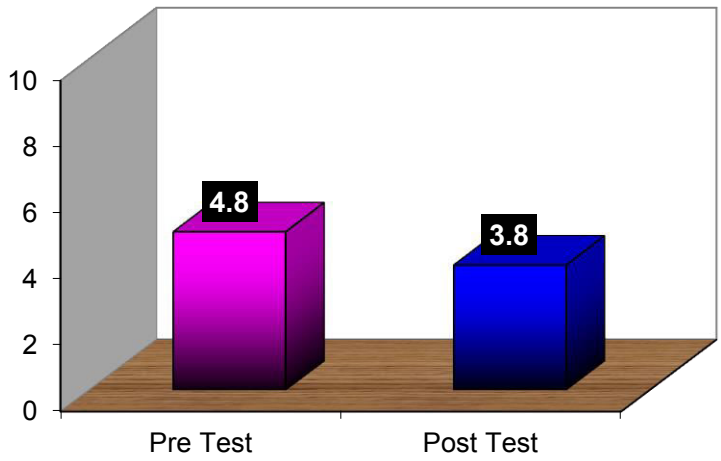
The Paired t-value of 10.32 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 5; Post test mean was 3.3 and mean difference was 1.7 which showed reduction on Perception of Dyspnoea in response to Heavy threshold Inspiratory Muscle Training for Group A samples.

Table II - Perception of Dyspnoea for Group B

The comparative mean values, mean difference, standard deviation and Paired t-values between Pre Vs Post test of Perception of Dyspnoea in Mild threshold Inspiratory Muscle trained Group-B.

S. No	Perception of Dyspnoea	Improvement			Paired t-value
		Mean	Mean difference	S.D	
1.	Pre-test	4.8	1	0.52	7.44
2	Post- test	3.8			

Graph II – Perception of Dyspnoea for Group B



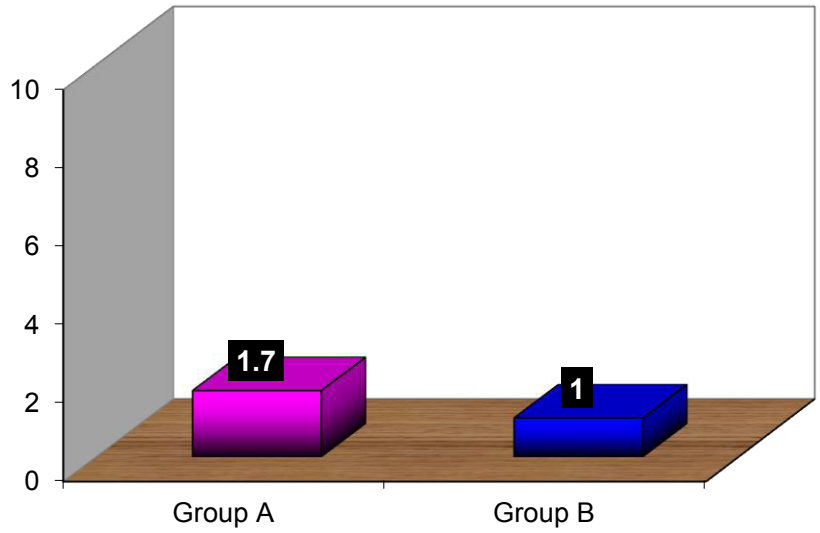
The Paired t-value of 7.44 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 4.8; Post test mean was 3.8 and mean difference was 1 which showed reduction on Perception of Dyspnoea in response to Mild threshold Inspiratory Muscle Training for Group B samples.

Table III - Perception of Dyspnoea for Group A & Group B

The comparative mean values, mean difference, standard deviation and Unpaired 't' –value between Group A and Group B on Perception Of Dyspnoea.

S. No	Perception of Dyspnoea	Improvement			Unpaired t-value
		Mean	Mean difference	S.D	
1.	Group - A	1.7	0.7	0.64	4.34
2	Group - B	1			

Graph III – Perception of Dyspnoea for Group A & Group B



The Unpaired t-value of 4.34 greater than the tabulated t-value of 2.05 showed that there was statistically significant difference at 0.05 level between mean difference of Group-A and Group-B. The Pre Vs Post mean of Group-A was 1.7; the Pre Vs Post mean of Group –B was 1 and the mean difference of Group A and Group B was 0.7,which showed greater reduction in Perception of Dyspnoea in Heavy threshold Inspiratory Muscle trained Group A when compared to Mild threshold Inspiratory Muscle trained Group B.

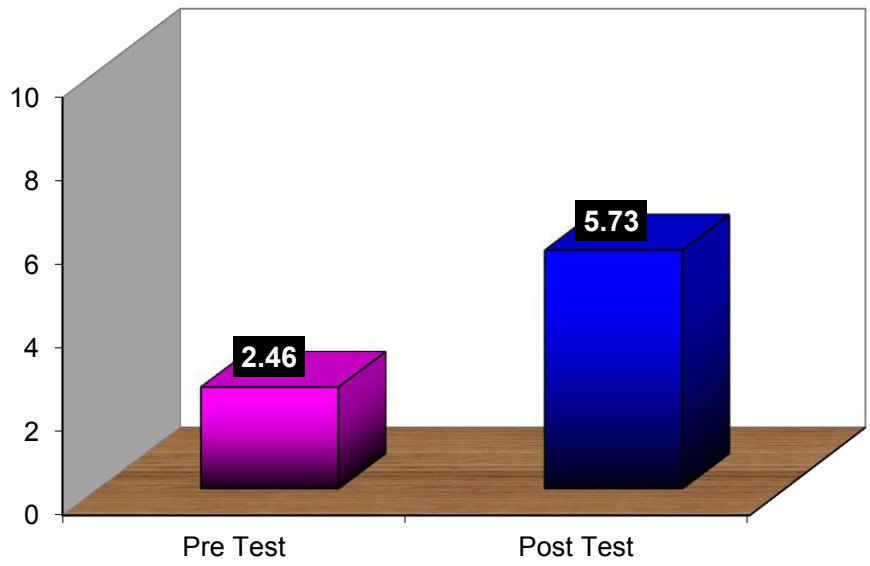
Therefore the study was rejecting the null hypothesis and was accepting alternate hypothesis.

Table IV – Quality of Life for Group A

The comparative mean values, mean difference, standard deviation and Paired t-values between Pre Vs Post test of Quality of Life(QOL) in Heavy threshold Inspiratory Muscle trained Group-A.

S. No	Quality of Life (QOL)	Improvement			Paired t-value
		Mean	Mean difference	S.D	
1.	Pre-test	2.46	3.27	0.92	12.61
2	Post- test	5.73			

Graph IV – Quality of Life for Group A



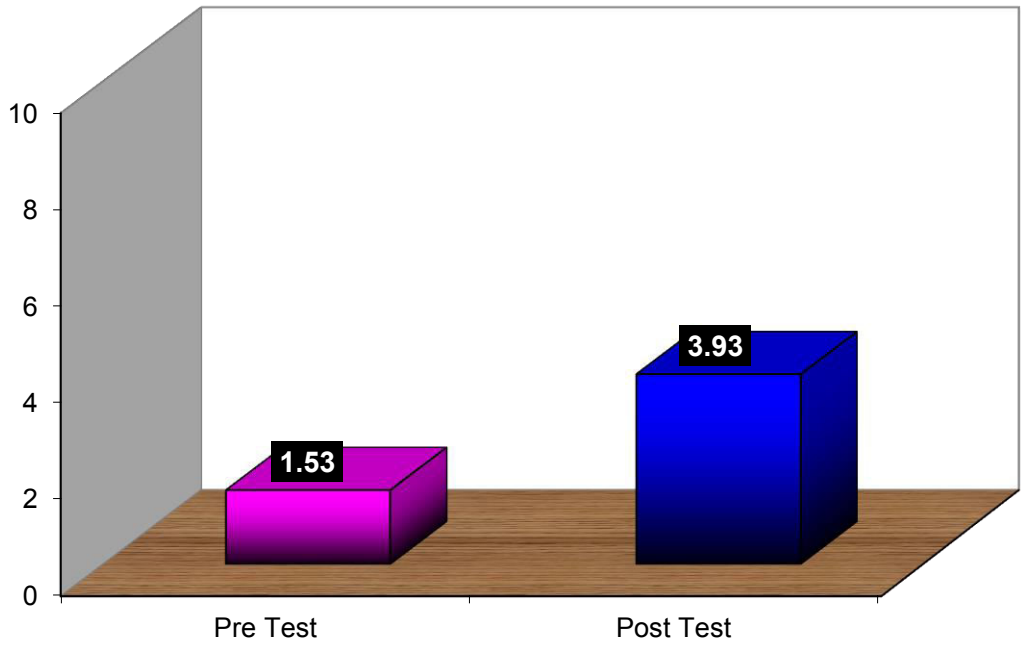
The Paired t-value of 12.61 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 2.46; Post test mean was 5.73 and mean difference was 3.27 which showed improvement in Quality of Life (QOL) in response to Heavy threshold Inspiratory Muscle Training for Group A samples.

Table V – Quality of Life for Group B

The comparative mean values, mean difference, standard deviation and Paired t-values between Pre Vs Post tests of Quality of Life (QOL) in Mild threshold Inspiratory Muscle trained Group-B.

S. No	Quality of Life (QOL)	Improvement			Paired t-value
		Mean	Mean difference	S.D	
1.	Pre-test	1.53	2.4	0.64	12.09
2	Post- test	3.93			

Graph V – Quality of Life for Group B



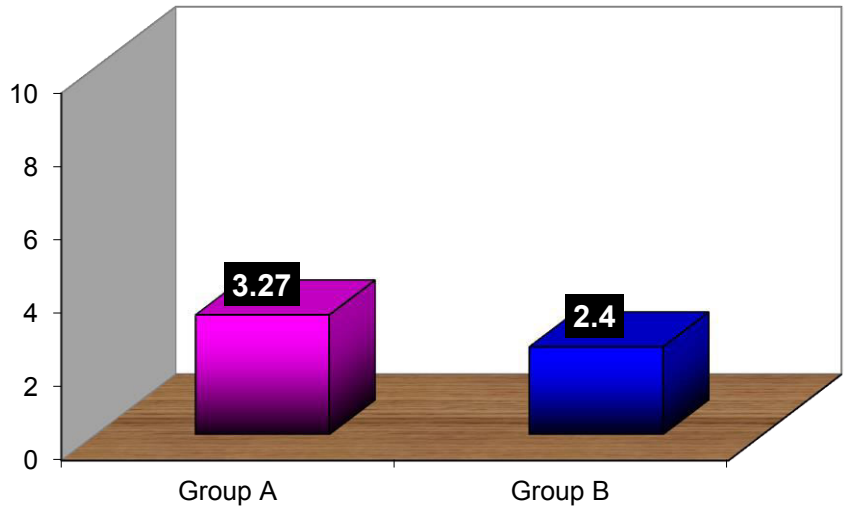
The Paired t-value of 12.09 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 1.53; Post test mean was 3.93 and mean difference was 2.4 which showed improvement in Quality of Life in response to Mild threshold Inspiratory Muscle Training for Group B samples.

Table VI – Quality of Life for Group A & Group B

The comparative mean values, mean difference, standard deviation and unpaired 't' –value between Group A and Group B on Quality of Life (QOL).

S. No	Quality of Life (QOL)	Improvement			Unpaired t-value
		Mean	Mean difference	S.D	
1.	Group - A	3.27	0.87	0.78	3.57
2	Group - B	2.4			

Graph VI – Quality of Life for Group A & Group B



The Unpaired t-value of 3.57 greater than the tabulated t-value of 2.05 showed that there was statistically significant difference at 0.05 level between mean difference of Group-A and Group-B. The Pre Vs Post mean of Group-A was 3.27; the Pre Vs Post mean of Group –B was 2.4 and the mean difference of Group A and Group B was 0.87,which showed significant improvement in Quality of Life (QOL) in Heavy threshold Inspiratory Muscle trained Group A when compared to Mild threshold Inspiratory Muscle trained Group B.

Therefore the study was rejecting the null hypothesis and was accepting alternate hypothesis.

CHAPTER V
DISCUSSION

The aim of the study was to compare the effect of Heavy threshold and Mild threshold Inspiratory Muscle Training on 30 COPD samples with Perception of Dyspnoea, Quality of Life (QOL) as parameters.

Discussion on Parameters

Based on the study of **Lisboa, Marinella Beckerman, Nield, Covey, David Hilman** the present study has taken Modified Borg Scale as one of the parameter to assess the Dyspnoea.

Based on the study of **Hildegard and Covey** the present study has taken CRQ as a scale and one of the parameter to measure Quality of Life (QOL).

Discussion on Heavy thershold Inspiratory Muscle Training in Group A

Based on the study of **Nield, Covey, Gavin Sturdy** the present study has given Heavy threshold inspiratory muscle training to Group A subject with Threshold Breathing Device.

Based on the study of **Preusser, Hildegard, Lisboa, Villafranca, Marinella Beckerman, David Hilman** the present study has given Mild threshold inspiratory muscle training to Group B subject with Threshold Breathing Device.

In the analysis and interpretation of Perception of Dyspnoea in Group A

The Paired t-value of 10.32 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 5; Post test mean was 3.3 and mean difference was 1.7 which showed reduction on Perception of Dyspnoea in response to Heavy threshold Inspiratory Muscle Training for Group A samples.

In the analysis and interpretation of Quality of Life in Group A

The Paired t-value of 12.61 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 2.46 ; Post test mean was 5.73 and mean difference was 3.27 which showed improvement in Quality of Life (QOL) in response to Heavythreshold Inspiratory Muscle Training for Group A samples.

The study results of Hildegard, Nield, Covey, and David Hilman were similar to the Present study results in which Heavy threshold Inspiratory Muscle Training improved Quality of Life and reduced Perception of Dyspnoea.

Discussion on Mild thershold Inspiratory Muscle Training in Group B

In the analysis and interpretation of Perception of Dyspnoea in Group B

The Paired t-value of 7.44 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 4.8; Post test mean was 3.8 and mean difference was 1 which showed reduction on Perception of Dyspnoea in response to Mild threshold Inspiratory Muscle Training for Group B samples.

In the analysis and interpretation of Quality of Life in Group B

The Paired t-value of 12.09 was greater than the tabulated t-value 2.14 showed that there was statistically significant difference at 0.05 level between Pre Vs Post test results. The Pre test mean was 1.53; Post test mean was 3.93 and mean difference was 2.4 which showed improvement in Quality of Life in response to Mild threshold Inspiratory Muscle Training for Group B samples.

The study results of Hildegard, Marinella Beckerman support the present study result in which mild thershold Inspiratory Training improved Quality of Life and reduced Perception of Dyspnoea.

Discussion on Heavy thershold and Mild threshold Inspiratory Muscle Training Between Group A and Group B

In the analysis and interpretation of Perception of Dyspnoea in Group A and Group B

The Unpaired t-value of 4.34 greater than the tabulated t-value of 2.05 showed that there was statistically significant difference at 0.05 level between mean difference of Group-A and Group-B. The Pre Vs Post mean of Group-A was 1.7; the Pre Vs Post mean of Group –B was 1 and the mean difference of Group A and Group B was 0.7,which showed greater reduction in Perception of Dyspnoea in Heavy threshold Inspiratory Muscle trained Group A when compared to Mild threshold Inspiratory Muscle trained Group B.

In the analysis and interpretation of Quality of Life in Group A and Group B

The Unpaired t-value of 3.57 greater than the tabulated t-value of 2.05 showed that there was statistically significant difference at 0.05 level between mean difference of Group-A and Group-B.The Pre Vs Post mean of Group-A was 3.27; the Pre Vs Post mean of Group –B was 2.4 and the mean difference of Group A and Group B was 0.87,which showed significant improvement in Quality of Life (QOL) in Heavy threshold Inspiratory Muscle trained Group A when compared to Mild threshold Inspiratory Muscle trained Group B.

The study result of Larson and Preusser supported the present study result in which Heavy threshold Inspiratory Muscle training in Group A showed more significant reduction in Perception of Dyspnoea than Mild thershold Inspiratory Muscle Training in
Group B.

The study result of Larson and Hildegard supported the present study result in which Heavy threshold Inspiratory Muscle training in Group A showed more significant improvement in QOL than Mild threshold Inspiratory Muscle Training in Group B.

Therefore the present study was accepting the alternate hypothesis and was rejecting the null hypothesis.

Reason for reduction in Perception of Dyspnoea following Heavy thershold and Mild threshold Inspiratory Muscle training:

1. **Weiner (2004)** specific IMT at different loads increases Forced Vital Capacity (FVC) of the patient, their overall lung volume increases. This produces a direct decrease in their airway resistance and decrease in their levels of dyspnoea.

2. **Kim (1984)** IMT at different loads increases the metabolic capability of muscle ,such that cellular concentrations of energy producing substrates drop to minimal levels thereby improving ventilatory function and reducing work of breathing.

3. **Kylie Hill (2006)** inspiratory muscle training at different loads improves inspiratory muscle strength and endurance thereby reducing respiratory muscle fatigue and Dyspnoea.

Reason for improvement in QOL following Heavy thershold and Mild threshold Inspiratory Muscle Training:

1. **Shane Keene (2007)** use of threshold devices repeatedly, increases the Inspiratory muscle strength. With strengthening of these muscles, the patients level of dyspnoea decreases as the work of breathing becomes easier and patients are able to perform physical activities more easily and improve their Health related Quality of Life (HRQL).

2. **Stephanie (2005)** increasing inspiratory muscle function induces morphological changes in the diaphragm and increases lung volumes. This further decreases work of breathing and increase the physical work capacity improving QOL.

Reason for improvement of QOL and reduction of Dyspnoea, more in Heavy thershold Inspiratory Muscle Training than Mild thershold Inspiratory Muscle Training:

1. **Leith and Bradley (1976)** - increase in vital capacity and Total lung capacity more in HIMT causing increased ability of inspiratory muscles to expand the thorax. This induces morphological changes (increase in thickness of diaphragm, increase in number and size of myofibrils) thereby increasing inspiratory muscle efficiency and reducing respiratory exertion more in HIMT than LIMT.

2. **Ramirez (2002)** improvement in inspiratory muscle strength and endurance more in HIMT due to structural changes in inspiratory muscle fibres. This help relieve dyspnoea and improve QOL more in HIMT than LIMT.

CHAPTER VI
SUMMARY AND CONCLUSION

6.1 SUMMARY

The Purpose of this study was to compare the effectiveness of Heavy threshold and Mild threshold Inspiratory Muscle Training in Moderate COPD Patients.

A total number of 30 subjects of age group between 40-60 years diagnosed as COPD were randomly selected for the study. They were divided into two groups; Heavy threshold Inspiratory Muscle Training (Group A) and Mild threshold Inspiratory Muscle Training (Group B).

After randomizing, Group A subjects were given Heavy threshold Inspiratory Muscle Training for a Period of 24 weeks. Group B subjects were given Mild threshold Inspiratory Muscle Training for a period of 24 weeks. Before and after 24 weeks of training program, the pre and post test values of Perception of Dyspnoea and Quality of Life were measured.

The Paired t-test was used to compare the Pre test Vs Post test values of Perception of Dyspnoea and Quality of Life.

Based on the statistical analysis, the result of this study showed that there was significant improvement in both groups following Heavy threshold and Mild threshold Inspiratory Muscle Training Programme.

Based on the analysis and interpretation of Perception of Dyspnoea, the unpaired t-value 4.34 was greater than the tabulated t-value 2.05 at 0.05 level which showed a statistically significant difference between Pre Vs. Post test results of Group A& B. The mean value of Group-A was 1.7; Group B was 1 and the mean difference was 0.7, which showed a significant reduction in Perception of Dyspnoea in High Intensity Inspiratory Muscle trained Group A compared to Mild threshold Inspiratory Muscle trained Group B.

Based on the analysis and interpretation of Quality of Life (QOL), the unpaired t-value 3.57 was greater than the tabulated t-value 2.05 at 0.05 level which showed a statistically significant difference between Pre Vs. Post test results of Group A & B. The mean value of Group-A was 3.27; Group B was 2.4 and the mean

difference was 0.87, which showed a significant improvement in Quality of Life (QOL) in Heavy threshold Inspiratory Muscle trained Group A compared to Mild threshold Inspiratory Muscle trained Group B.

6.2 CONCLUSION

The study showed a significant reduction in and Perception of Dyspnoea and an Increase in Quality of Life (QOL) in COPD patients after the Heavy threshold and Mild threshold Inspiratory Muscle Training.

The study showed that the Heavy threshold Inspiratory Muscle Training was most effective than Mild threshold Inspiratory Muscle Training on Perception of Dyspnoea and Quality of Life (QOL).

CHAPTER VII
LIMITATIONS AND SUGGESTIONS

LIMITATIONS:

- A control group with only conventional therapy was not used in this study.
- CRQ SAS was only used for measuring the Quality of life.
- Only t test was used for statistical analysis.

SUGGESTIONS:

- A similar study can be conducted with respiratory muscle training to improve exercise performance in healthy subjects.
- A similar study can be conducted with Inspiratory muscle training at different loads for patients with severe COPD.
- A similar study can be conducted with Inspiratory muscle training for chronic heart failure patients.
- A similar study can be conducted with Inspiratory muscle training at different loads for patients with neuromuscular diseases.
- A similar study can be conducted with Inspiratory muscle training for patients with spinal cord injury.

CHAPTER VIII
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CHAPTER IX

ANNEXURE

ANNEXURE I - INFORMED CONSENT FORM

TITLE: EFFECTIVENESS OF HIGH INTENSITY LOW INTENSITY INSPIRATORY MUSCLE TRAINING IN PATIENTS WITH MODERATE COPD"

INVESTIGATOR:

CO-INVESTIGATORS:

PURPOSE OF THE STUDY:

I ---------- ---------- have been informed that this study will help clinicians ,& therapists to find out the ----------
---

PROCEDURE:

I understand that I' ll undergo ----------

----------under the direct supervision of the physiotherapist. I am aware that I have to follow therapist's instruction as has been told to me.

RISK AND DISCOMFORT:

I understand that there are no potential risks associated with this procedure, and understand that----------
---------- will accompany me during this procedure. There are no known hazards associated with this procedure.

CONFIDENTIALITY:

I understand that the medical information produced by this study will be confidential. If the data are used for publication in the medical literature or for teaching purpose, no names will be used. And photographs, audio and videotapes will be used without identity for publication and presentation.

PHOTOGRAPHY CONSENT:

--------- Have explained to me that photography are required in order to illustrate various aspects of the study for the thesis and other articles, and at the presentation or conference. By giving my consent I authorize---------- to use any of the photographs taken of me in printed format, in slides for presentation.

REQUEST FOR MORE INFORMATION:

I understand that I may ask any question about the study at any times. ----------are available to answer my question. Copy of this concern form will be given to me keep for my careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may withdraw consent and discontinue participation at any time after he has explained the reasons for doing so.

INJURY STATEMENT:

I understand that the diagnostic/ treatment procedure, under the guidance of my therapist, is likely to cause any / no injury. In such case medical attention will be provide, but no compensation will be provided. I understand my agreement to participation in this study and I am not waiving any of my legal rights. I confirm that-

---

---------- have explained me the purpose of the study, the study procedure and possible rick that I may experience.

I have read and I have understood this concern to participate as a subject in this study.

---------- ----------

SUBJECT **DATE**

---------- ----------

WITNESS SIGNATURE **DATE**

I have explained----------the purpose of the research, the procedure required and the possible risks and benefits, to the best of my ability.

---------- ----------

INVESTIGATOR **DATE**

ANNEXURE II - ASSESSMENT CHART

Name : Date:

Age :

Sex :

Occupation :

Address :

Chief Complaints :

Subjective Examination :

Objective Examination :

i) Observation :

ii) Palpation :

iii) Examination :

Diagnosis :

Mode of Treatment

Treatment	***Given***
High Intensity Training	
Low Intensity Training	

Prognosis Chart

	Pre Test	***Post Test***
Modified Borg Scale		
Chronic Respiratory Questionnaire		

ANNEXURE III - PARAMETER

CHRONIC RESPIRATORY QUESTIONNAIRE

This questionnaire is designed to find out how you have been feeling during the last 2 weeks. In the first section, you will be asked to answer questions about activities which make some people feel short of breath. In the next section, you will answer questions about your mood and how you have been feeling.

Please read these instructions for completing this questionnaire:

Please read each question carefully and then place an "x" in the box beside the answer that best describes you. If you are unsure about how to answer a question, please give the best answer you can.

If you would like to change an answer, put a line through the box you want to change. Place an "x" in the box beside the option you would like to choose instead. Remember, there are no right or wrong answers.

Your answers to this questionnaire will be kept confidential.

Below is a list of activities which make some people with lung problems feel short of breath.

For each of the items below, place an "x" in the box that best describes how much shortness of breath you have had while doing that activity during the **LAST 2 WEEKS.**

The last column has been provided for you to indicate if you have **NOT DONE** an activity during the last two weeks.

(Place an "x" in one box on each line)

	ACTIVITIES:	Extremely short of breath	Very short of breath	Quite a bit short of breath	Moderate shortness of breath	Some shortness of breath	A little shortness of breath	Not at all short of breath	Not Done
1	Feeling emotional such as angry or upset	1	2	3	4	5	6	7	8
2	Taking care of your basic needs (bathing, showering, eating or dressing)	1	2	3	4	5	6	7	8
3	Walking	1	2	3	4	5	6	7	8
4	Performing chores (such as housework, shopping, groceries)	1	2	3	4	5	6	7	8
5	Participating in social activities	1	2	3	4	5	6	7	8

These next questions ask you about your energy in general and how your mood has been during the **LAST 2 WEEKS**. Please put an "x" in a box, from 1 to 7 that best describes how you have felt.

6. In general, how much of the time during the **LAST 2 WEEKS** have you felt frustrated or impatient?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

7. How often during the **LAST 2 WEEKS** did you have a feeling of fear or panic when you had difficulty getting your breath?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

8. What about fatigue? How tired have you felt over the **LAST 2 WEEKS?**

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

9. How often during the **LAST 2 WEEKS** have you felt embarrassed by your coughing or heavy breathing?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

10. In the **LAST 2 WEEKS**, how much of the time did you feel very confident and sure that you could deal with your illness?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

11. How much energy have you had in the **LAST 2 WEEKS**?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

12. In general, how much of the time did you feel upset, worried, or depressed during the **LAST 2 WEEKS**?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

13. How often during the **LAST 2 WEEKS** did you feel you had complete control of your breathing problems?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

14. How much of the time during the **LAST 2 WEEKS** did you feel relaxed and free of tension?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

15. How often during the **LAST 2 WEEKS** have you felt low in energy?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

16. In general, how often during the **LAST 2 WEEKS** have you felt discouraged or down in the dumps?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

17. How often during the **LAST 2 WEEKS** have you felt worn out or sluggish?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

18. How happy, satisfied, or pleased have you been with your personal life during the **LAST 2 WEEKS**?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

19. How often during the **LAST 2 WEEKS** did you feel upset or scared when you had difficulty getting your breath?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

20. In general, how often during the **LAST 2 WEEKS** have you felt restless, tense, or uptight?

1	All of the time	☐	
2	Most of the time	☐	
3	A good bit of the time	☐	
4	Some of the time	☐	(Place an 'X' in one box only)
5	A little of the time	☐	
6	Hardly any of the time	☐	
7	None of the time	☐	

Domain scores:

The scores for each question of each dimension are added together AND DIVIDED BY THE NUMBER OF completed QUESTIONS IN EACH DOMAIN.

Review of the completed questionnaire should occur to ensure that questions are not missed during the completion of the questionnaire.

Dyspnea domain: The mean of questions 1, 2, 3, 4, 5 (question 1 + question 2 + question 3 + question 4 + question 5) divided by the number of questions answered excluding those not done (typically 5, but sometimes respondents do not respond to all questions)

Fatigue: The mean of questions 8, 11 15, 17 calculated as the score (question 8 + question 11 + question 15 + question 17) divided by 4, which is the number of questions answered (questions not answered or missed should be excluded).

Emotional Function: The mean of questions 6, 9, 12, 14, 16, 18, 20 calculated as the score (question 6 + question 9 + question 12 + question 14 + question 16, + question 18 + question 20) divided by 7, which is the number of questions answered (questions not answered or missed should be excluded).

Mastery: The mean of questions 7, 10, 13, 19 calculated as the score (question 7 + question 10 + question 13 + question 19) divided by 4, which is the number of questions answered (questions not answered or missed should be excluded).

MODIFIED BORGS SCALE (For Dyspnoea)

Dyspnoea in daily activities was assessed using modified Borg Scale.

Rate of perceived exertion (Borg Scale)

0	-	Nothing at all
0.5	-	Very very weak
1	-	Very weak
2	-	Weak
3	-	Moderate
4	-	Somewhat strong
5	-	Strong
6	-	
7	-	Very strong
8	-	
9	-	
10	-	Very very strong

ANNEXURE IV – MASTER CHART

GROUP A

(HIGH INTENSITY INSPIRATORY MUSCLE TRAINING)

S.No.	Perception of Dyspnoea		Quality of Life (QOL)	
	Pre	Post	Pre	Post
1.	5	3	3	5
2.	5	4	3	5
3.	5	3	3	6
4.	6	3	3	5
5.	4	2	3	6
6.	5	4	2	5
7.	5	4	4	6
8.	4	2	2	6
9.	6	4	2	6
10.	6	5	2	6
11.	5	2	2	6
12.	5	3	2	6
13.	5	4	2	6
14.	4	2	2	6
15.	6	5	2	6

GROUP B

(LOW INTENSITY INSPIRATORY MUSCLE TRAINING)

S.No.	Perception of Dyspnoea		Quality of Life (QOL)	
	Pre	Post	Pre	Post
1.	4	3	3	5
2.	5	5	2	4
3.	5	4	2	4
4.	4	3	2	5
5.	4	3	2	4
6.	4	4	3	6
7.	6	5	1	3
8.	4	3	1	4
9.	6	5	1	3
10.	6	5	1	4
11.	5	3	1	3
12.	5	4	1	3
13.	4	3	1	4
14.	6	4	1	4
15.	4	3	1	3